

Peritoneal Dialysis Principals & Technical Aspects

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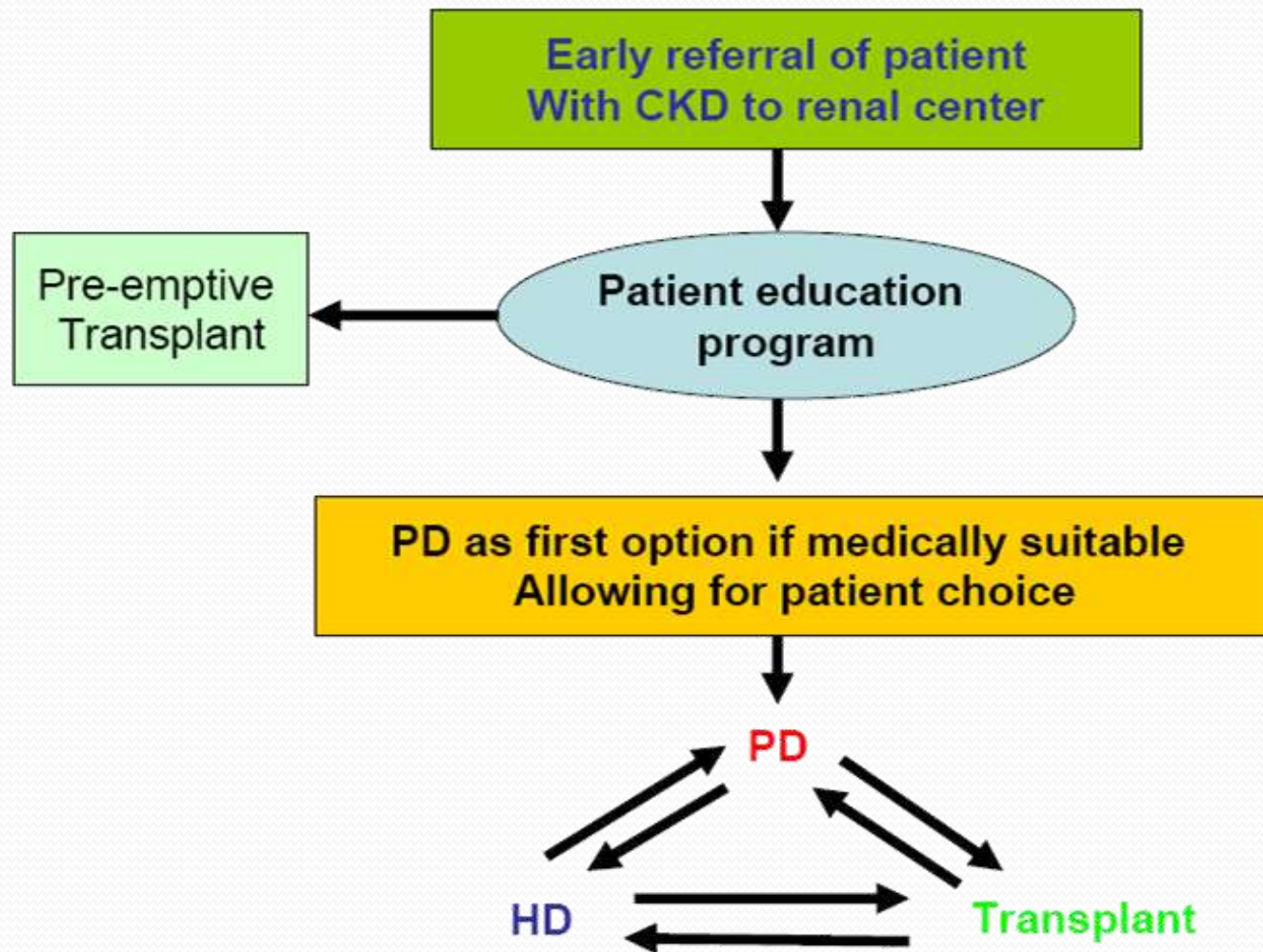
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Objectives

- ☐ **Introduction**
- ☐ **Principles of PD**
- ☐ **Technical Aspects**
 - ☐ **Why to start with PD ?**
 - ☐ **Patients Selection**
 - ☐ **PD catheters , solution and PD modalities**
 - ☐ **Complications**
- ☐ **PD in Egypt**
- ☐ **Conclusion**

Managing New Patient with ESRD



Managing New Patient with ESRD

- The therapeutic strategy that plans the sequence of renal replacement modalities which will increase the total survival as long as possible, and provide the best quality of life for the ESRD patient.
- OR:

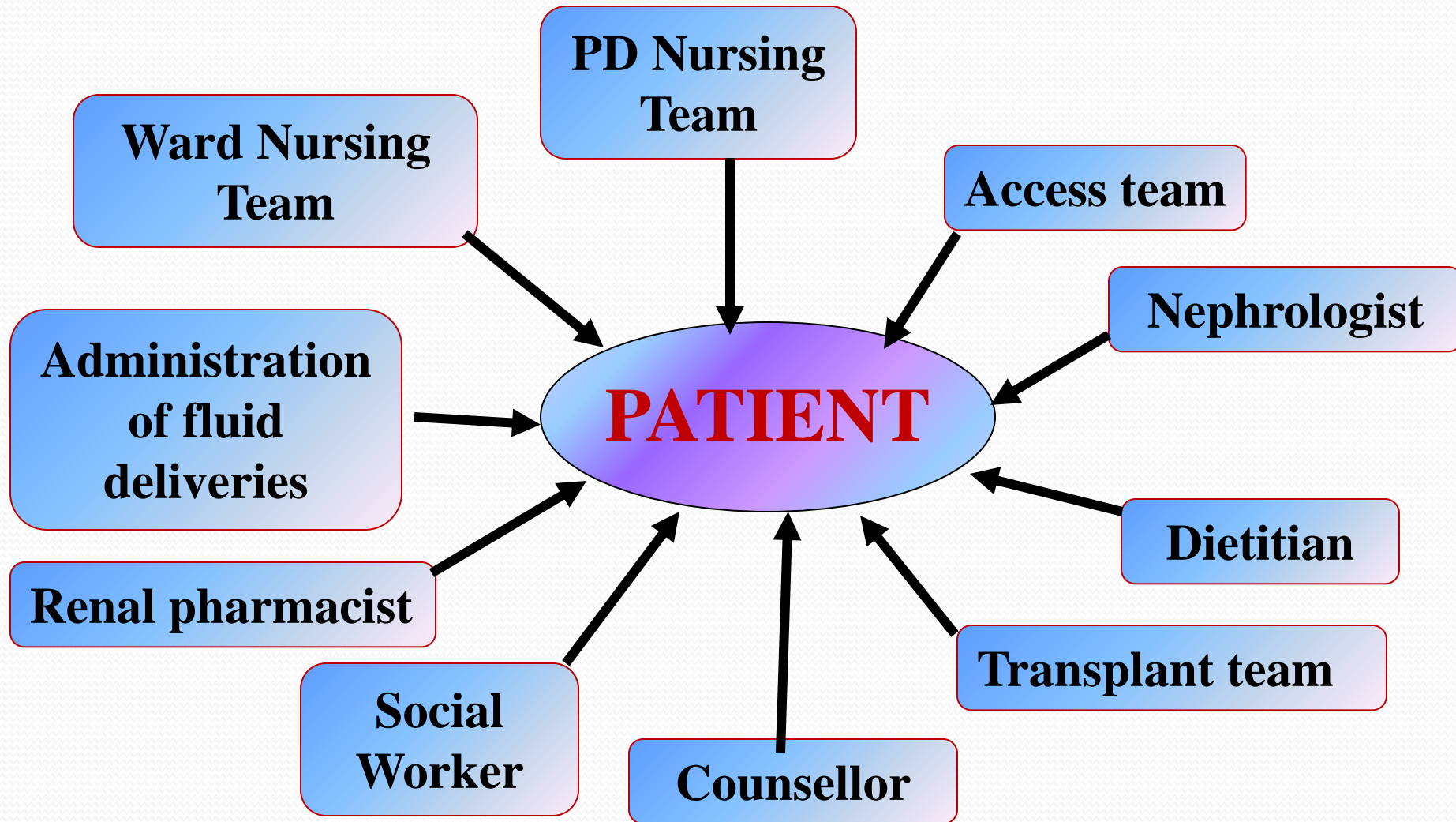
“The right modality at the right time.”

Peter Blake, MD, John Burkart, MD

“Complementary Not Competitive”

Coles 1998

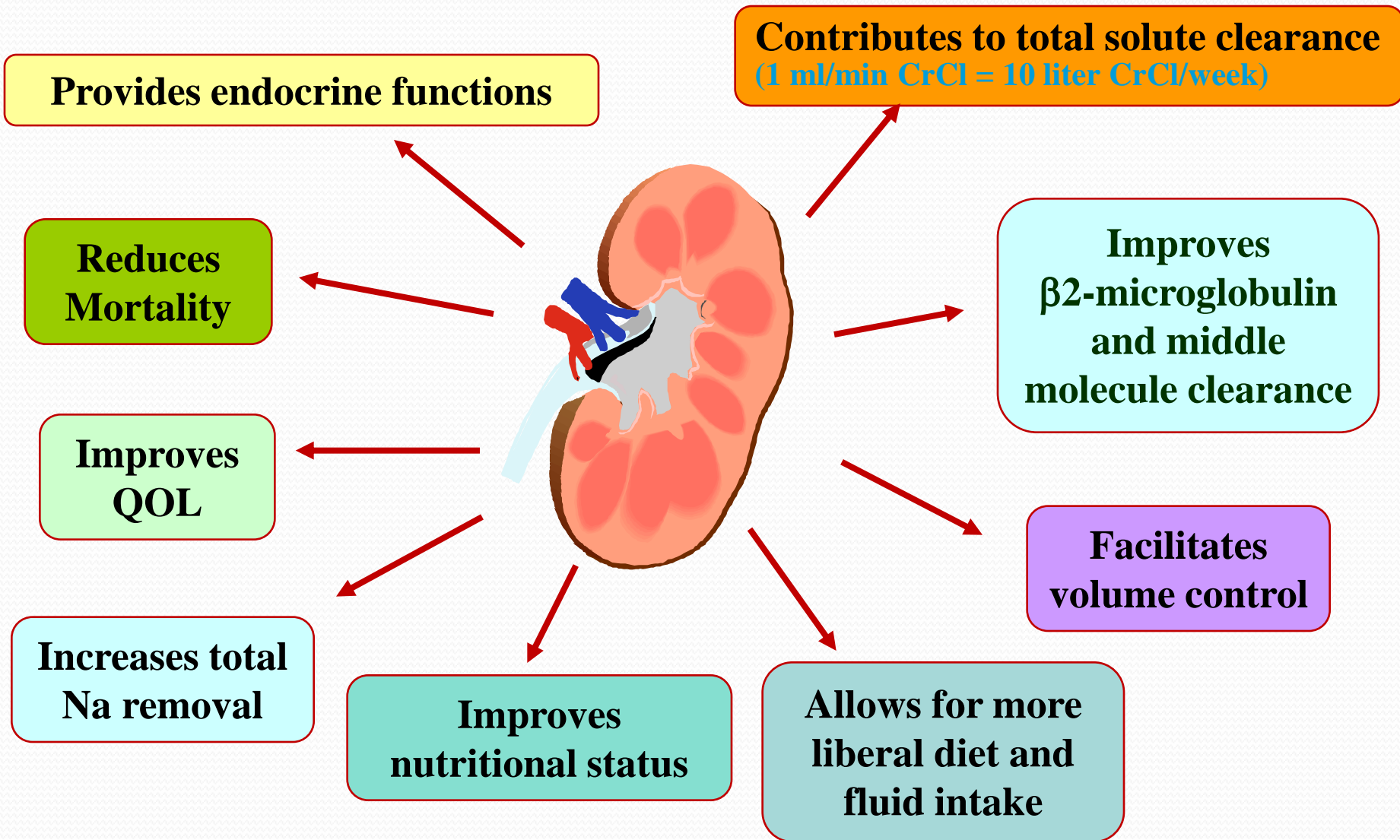
Multidisciplinary Team



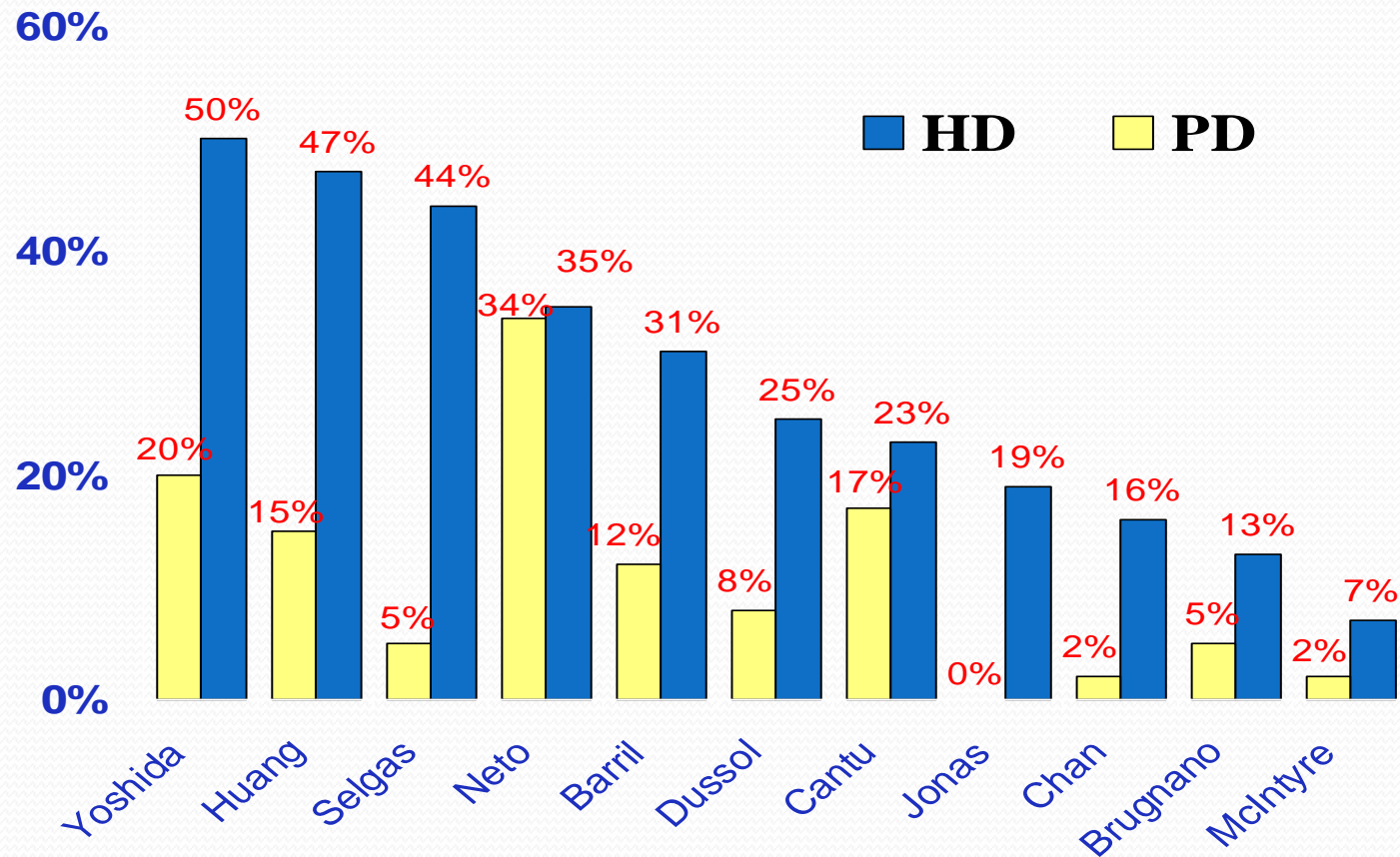
Why to start with PD ?

- Preservation of RRF
- Higher Hb concentration
- Less risk of acquiring blood borne infections e.g. HCV
- Better quality of life
- Travel , employment
- It allows expansion with limited resources
- Lower staff / patient ratio
- saves vascular access
- preferred for children (APD)

What Are the Benefits of Preserving RRF?



Prevalence of *anti-HCV* Among Patients on Dialysis by Modality



Survival of diabetics on HD Vs diabetic in PD

Year	1995-1998	1999-2001	2002-2004
Peritoneal Dialysis			
2 -year RR Death			
Unadjusted	1.00	0.95 (0.92-0.98) **	0.83 (0.80-0.86) ***
Adjusted	1.00	0.90 (0.86-0.94) **	0.79 (0.76-0.84) ***
Haemodialysis			
2 -year RR Death			
Unadjusted	1.00	1.02 (1.01-1.03) **	1.00 (0.99-1.01)
Adjusted	1.00	0.98 (0.97-0.98) **	0.95 (0.94-0.96) ***

CONCLUSIONS:

The survival of patients has increased significantly on PD relative to HD from 1995-2005, particularly in older age groups.

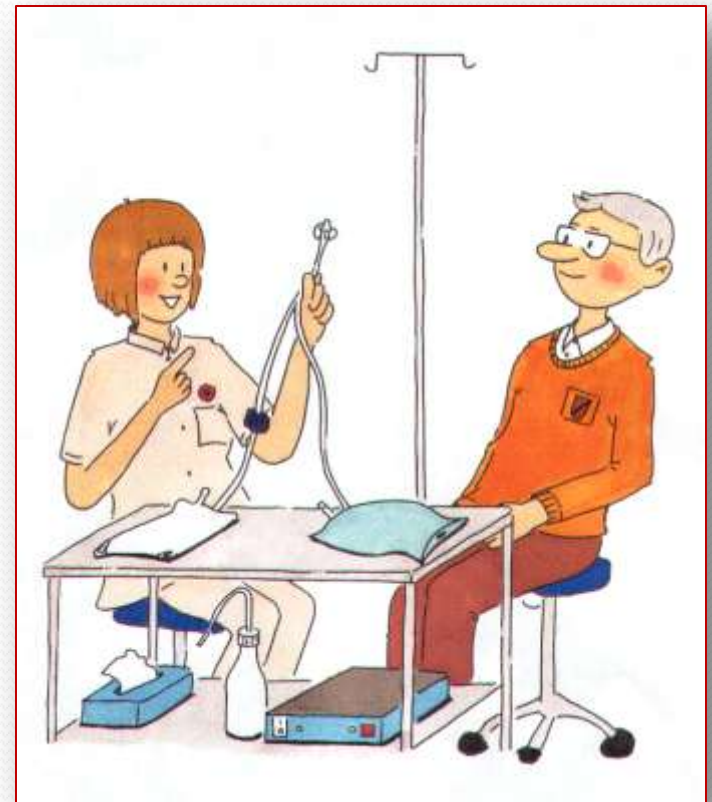
Stackl, et al., 2009

Logistics of PD versus HD

40 Nurses per **100** HD-patients.

4 Nurses in the Out-patient Clinic per **100** PD-patients.

Saving **36** nurses



Patient selection

- ❑ Selecting RRT modalities is influenced by a number of **considerations such as**
 - ❑ Patient Preference .
 - ❑ Availability And Convenience.
 - ❑ Underlying Medical Problems and Comorbid Conditions.
 - ❑ Socioeconomic and Dialysis Center Factors.
 - ❑ The Patient's Home Situation
 - ❑ Medical staff Training.

Patient selection

Indications for PD include:

- ✓ VA failure
- ✓ CHF
- ✓ children aged 0-5 years
- ✓ social situations: as pt. preference and distant from HD unit.
- ✓ intolerance to HD
- ✓ prosthetic valvular disease

PD preferred in :-

- ✓ bleeding diathesis
- ✓ age between 6 and 16 years
- ✓ possibility of TX in the near future
- ✓ needle anxiety
- ✓ active lifestyle.

Patient selection

Absolute Contraindications

Extensive peritoneal fibrosis and adhesions arising from previous surgery or inflammatory bowel disease.

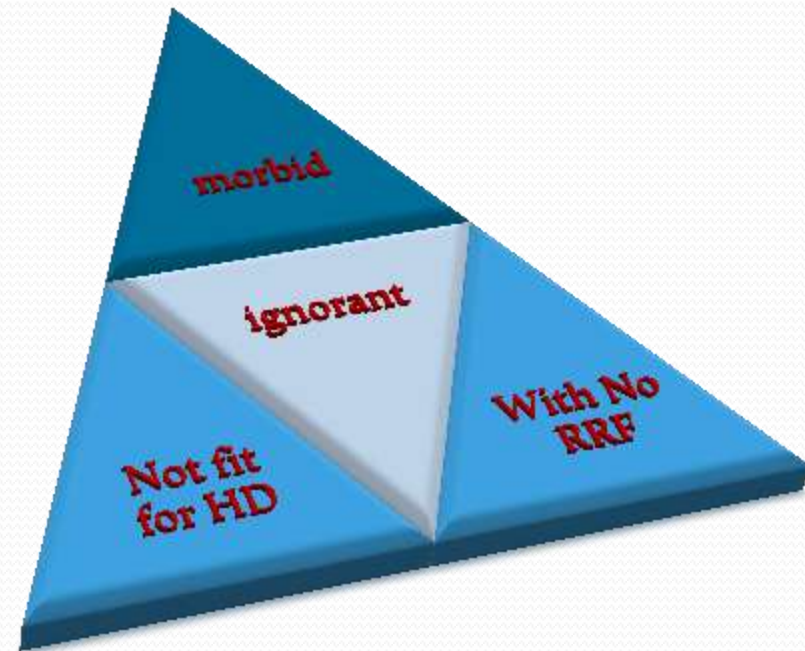
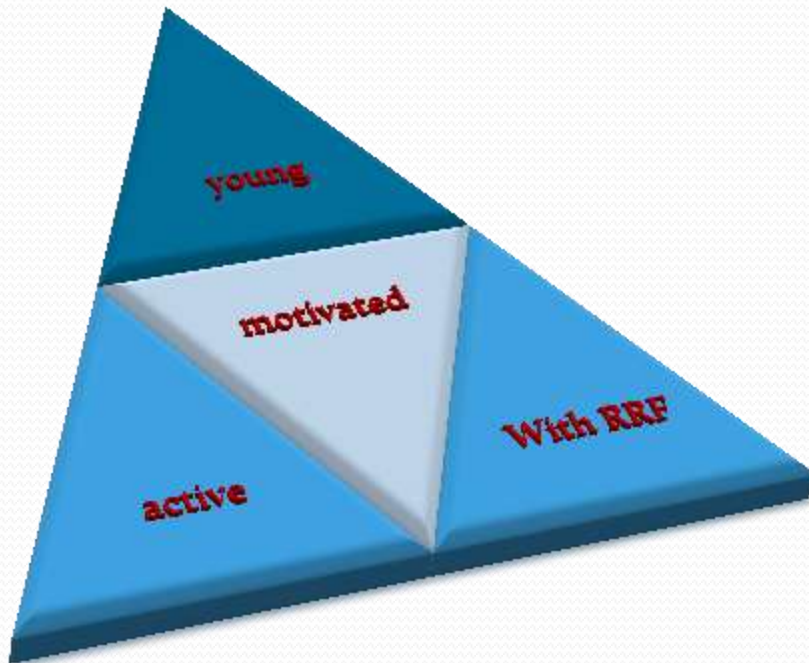
Relative Contraindications

1. Abdominal hernias.
2. Colostomy, ileostomy, nephrostomy and ileal conduits.
3. Poor vision, neurological and rheumatological disorders.
4. Psychological problems.
5. Chronic obstructive airways diseases.
6. Severe diverticular disease of the colon.
7. Morbid obesity.

Patient selection

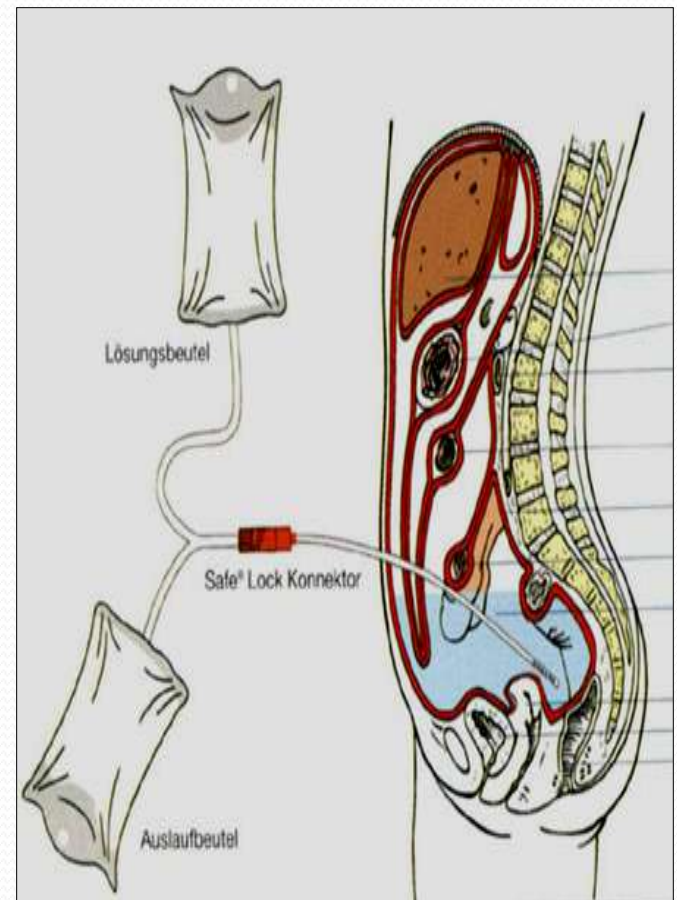
Positive selection make
successful program

Negative selection make
Un-successful program



Principles of PD

- **Dialysis fluid** is introduced to the **peritoneal cavity** through a catheter placed in the lower part of the abdomen.
- peritoneum serves as the **dialysis membrane**. The peritoneal cavity can often hold more than 3 litres, but in clinical practice only 1.5 – 2.5L of fluid are used.
- **Solutes** are transported across the membrane by **diffusion**.
- Fluid is removed by **ultrafiltration** driven by an osmotic pressure gradient.



peritoneal catheters

Types

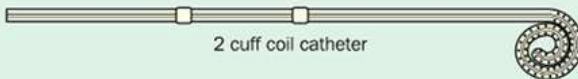
Common types of peritoneal dialysis catheter



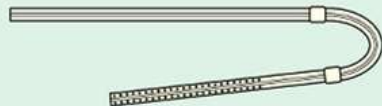
Straight 1 cuff catheter



Straight 2 cuff catheter



2 cuff coil catheter

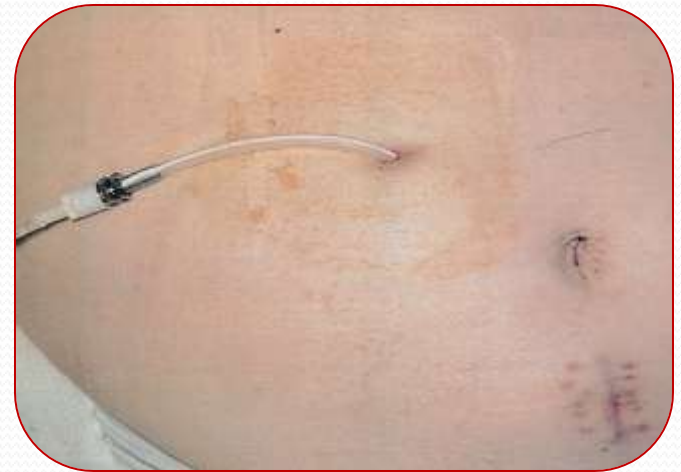


Swan neck catheter



Toronto Western catheter

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- **implanted via laparoscopy, puncture or laparotomy**
- **PD is started 3 weeks following the impantation of catheter**

P.D. solution

Made up of three essential compositions.

- 1 -Osmotic agent**
- 2 -Electrolytes**
- 3 -Acid – Base buffer**



Osmotic agent

Glucose :

- ❑ Glucose was the only osmotic agent available until 1990.
- ❑ It is not directly toxic, effective and inexpensive available in con. 1.36% 1.5% 2.2% 3.86 and 4.25% with high glucose concentration is used for effective UF

Electrolytes

Sodium (Na)

- Na conc. In P.D. Solution is bet 130 – 137 mEq/L.

Potassium (K)

- K can in available solution from (0 to 2 mEq/L).
- In hyperkalemic patient K free solution used to maximize K removal and to avoid hypokalemia add 1 to 4 mEq/L.

Calcium (Ca⁺)

- Ca level in the dialysate solution varies from 0 to 1.75 mmol/L.
- Ca level 1.0 to 1.25 mmol/L lead to adequate Ca balance & Ph control with oral Ca binder.
- Low Ca dialysate (0.6 – 1 mmol/L) is used in sever hyperparathyroid-ism.

Magnesium

- Mg. in P.D. Solution at concentration varies from 0.25 to 0.75 mmol/l may be associated with hypermagnesiumia, but some author suggest that ↑↑ Mg level may inhibits bone remodeling and protect soft tissue calcification.

Acid – Base buffer

The buffer composition of available P.D. solutions can be divided into three categories.

- Non bicarbonate buffers
- Bicarbonate / lactate combination buffers
- Bicarbonate buffers

Bicarbonate / lactate combination buffer

combination of lactate (15 mmol/L) and bicarbonate (25 mmol/L) Baxter

With osmolarity similar to glucose with P.H 7.4 . the bags are doubles chambered with glucose separated from Na bicarbonate and lactate.

Advantage:-

- Standard glucose exposure.
- Standard UF profile.
- Normal pH.
- Less peritonitis.
- Less inflow pain.



New PD solutions

Physioneal

- ↓ Infusion pain
- ↓ Peritonitis
- ↑ Glycemic control
- ↑ Appetite
- ↑ Patient acceptance
- No ↓ UF

Extraneal

- ↓ Glucose load
- ↑ Glycemic control
- ↑ UF, control of fluid status
- ↓ Dyslipidemia
- ↑ Quality of life
- ↑ Time on PD

Nutrineal

- ↓ Glucose load
- ↑ Glycemic control
- ↑ Protein intake, nutritional status

Types of Chronic Peritoneal Dialysis

- **CAPD** **(Continuous Ambulatory Peritoneal Dialysis)**
- **APD** **(Automated Peritoneal Dialysis)**
- **CCPD** **(Continuous Cycling Peritoneal Dialysis)**
- **IPD** **(Intermittent Peritoneal Dialysis)**
- **NIPD** **(Nocturnal Intermittent Peritoneal Dialysis)**
- **TPD** **(Tidal Peritoneal Dialysis)**

CAPD



1. Fill Phase

(<15 minutes)

* Disconnect

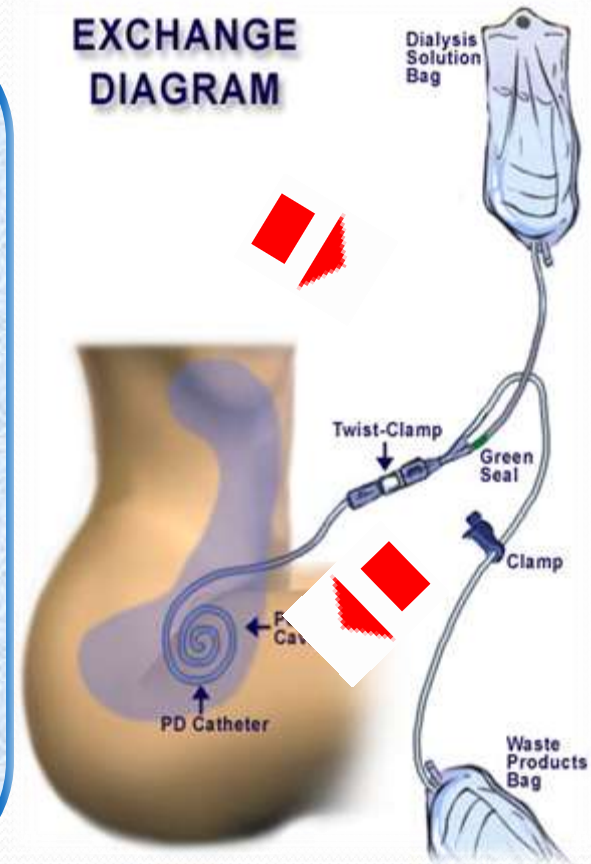
2. Dwell phase

(4-8 hours)

3. Drain phase

(<20 minutes)

EXCHANGE DIAGRAM



Automated Peritoneal Dialysis(APD)

Indications

1. Children
2. Inadequate solute or fluid removal
3. High intraperitoneal pressure Hernia
4. Polycystic disease
5. (Recurrent) dialysate leaks
6. Loss of appetite
7. Lifestyle

Disadvantages

More difficult to learn

Disturbed sleep

Attached to machine

Sexual problems

More expensive



Complications of PD therapy

infectious

Non infectious

Peritonitis

Exit site

Tunnel



Acute



Chronic



peritonitis

- It is the major complication of PD and remains the main reason for switching patient to HD .
- The rate should not be > 1 episode/18 patient-month or 0.67 episode / year at risk (ISPD guidelines)

clinical presentation of peritonitis

- ➡ abdominal pain (80%)
- ➡ cloudy fluid or drainage
- ➡ fever (50%)
- ➡ nausea (30%)
- ➡ diarrhoea (7-10%)
- ➡ poor drainage
- ➡ loss of UF function

Diagnosis of peritonitis

Based on the number of WBCs : 50 – 100 wbc / mm³.

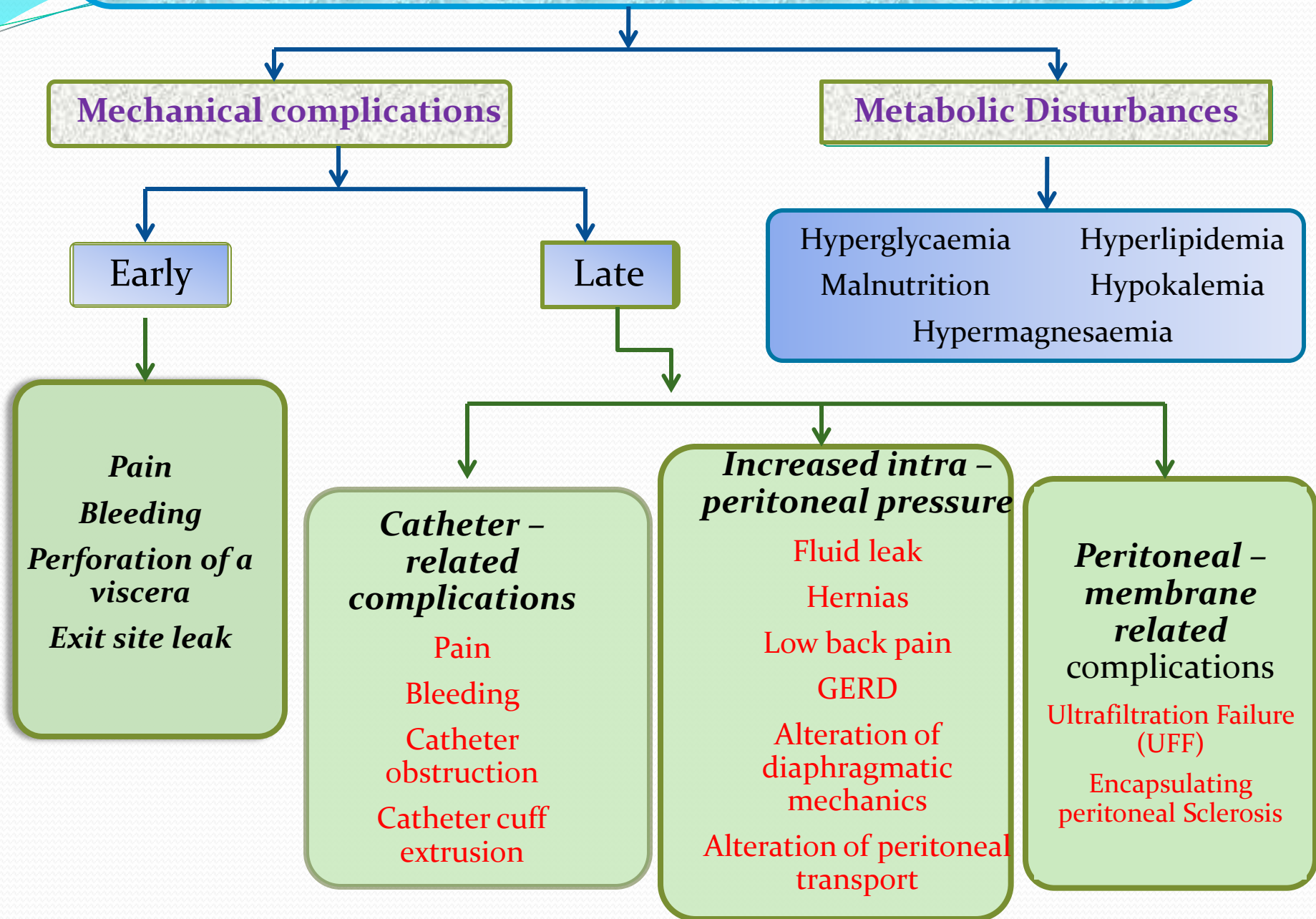
- A gram stain should be done.
- Bacteria are present in low concentrations in PD fluid.
- Culture negative ~ 20% of cases.
- yield of positive cultures increased by inoculating fluid into blood culture bottles.
- positive culture, in the absence of WBCs usually represent contamination
- sterile culture: antibiotic, poor culture technique, early sampling.'

Initial therapy

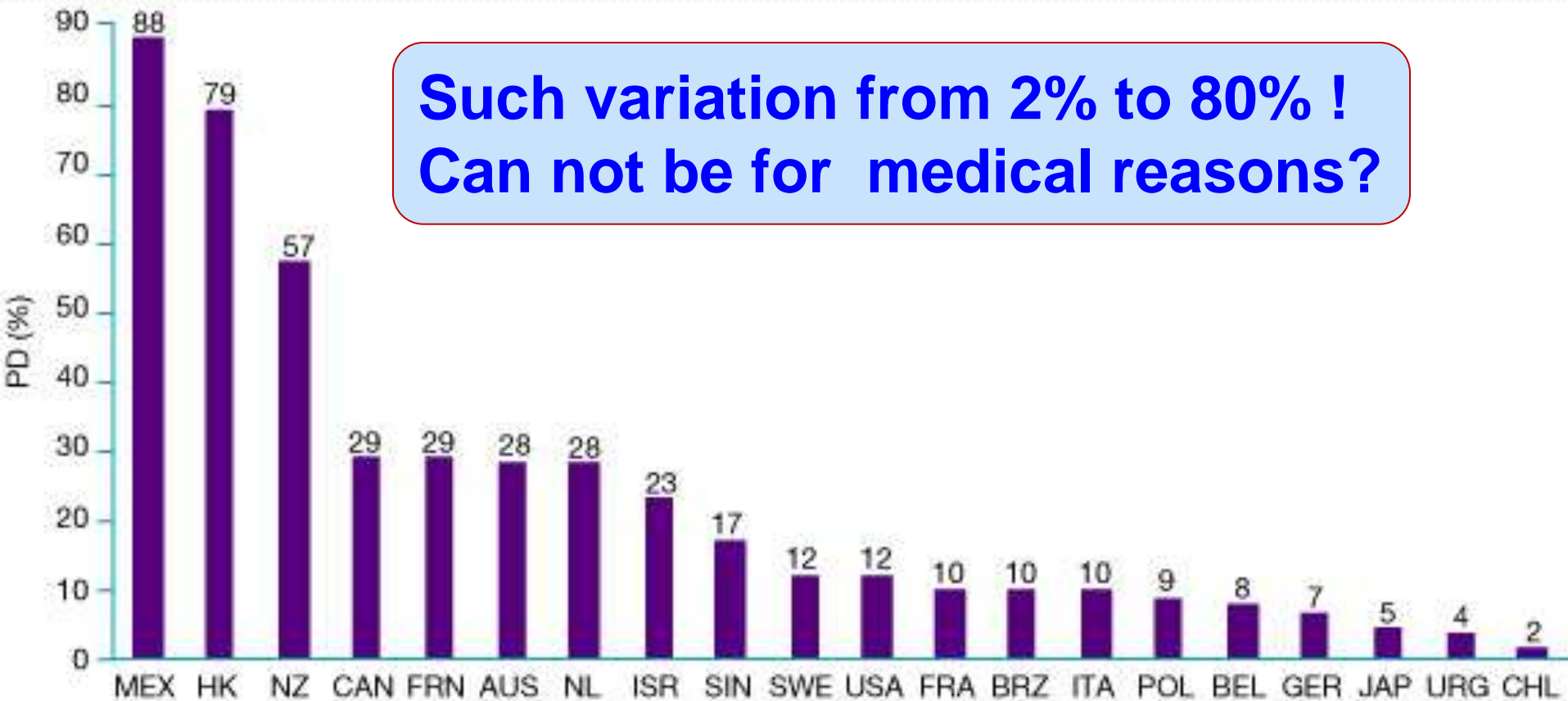
Initiate empiric therapy with Cefazolin or Cephalothin and OR Glycopeptide (Vancomycin or Teicoplanin) and Ceftazidime

	Continuous dosing	Intermitt. dosing
<i>Cefazolin or cephalothin</i>	250 mg/L load, then 125 mg/L in each exchange	15 mg/kg in a single exchange/day
<i>Ceftazidime</i>	250 mg/L load, then 125 mg/L /change	15 mg/kg in a single exchange /day
<i>Vancomycin</i>	500 mg/L load, then 30mg/L /change	30 mg/kg in a single exchange q 5-7 days
<i>Teicoplanin</i>	200 mg/L load, then 20mg/L /change	15 mg/kg in a single exchange q 5-7 d.

Non-infectious Complications of Peritoneal Dialysis



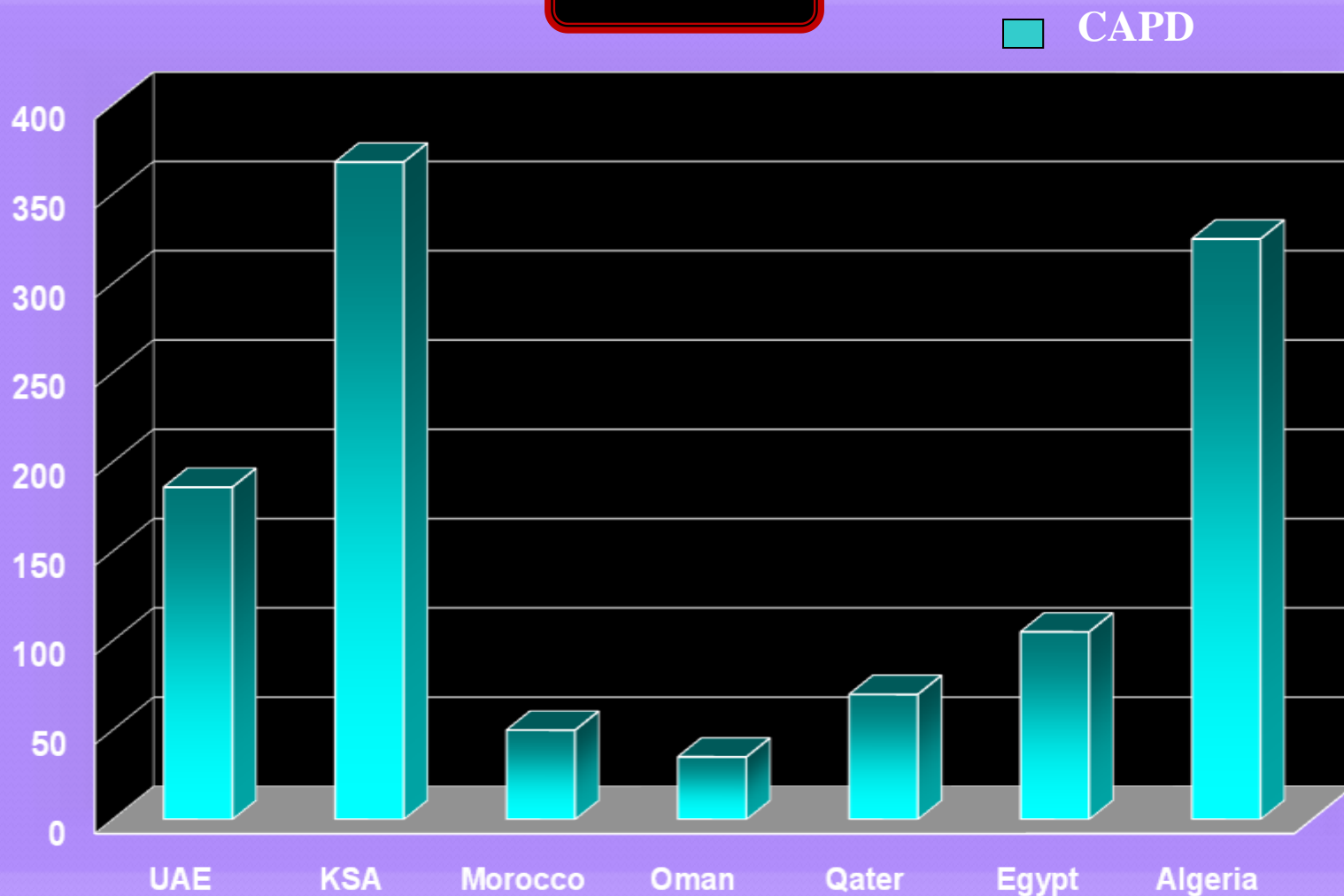
PD utilization in various countries worldwide (from USRDS data 1999).





PERITONEAL DIALYSIS IN THE ARAB WORLD

CAPD



PD in Egypt

Number of patients in Egypt

No accurate data









Conclusion

- ❖ Integrated care approach is the optimal treatment for ESRD*
- ❖ PD is superior to HD in the first two years of starting RRT.*
- ❖ PD is the solution for overcrowded dialysis units*
- ❖ PD is underutilize in Egypt , more effort from nephrologists , government and local companies to support PD program in Egypt.*



Thank you